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**From:** d'Almeida, Carolyn K. [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9EC4401AFA1846DD93D52A0DDA973581-CDALMEID]  
**Sent:** 3/4/2015 8:31:57 PM  
**To:** Harry Hendler [Hendler.Harry@azdeq.gov]  
**CC:** Henning, Loren [Henning.Loren@epa.gov]  
**Subject:** FW: 2015-3-3 - wafb - thanks - LNAPL containment ST012 -

Harry - FYI, as Wayne is out of the office today

Carolyn

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**From:** d'Almeida, Carolyn K.  
**Sent:** Wednesday, March 04, 2015 10:57 AM  
**To:** 'Wayne Miller'; Davis, Eva  
**Cc:** steve  
**Subject:** RE: 2015-3-3 - wafb - thanks - LNAPL containment ST012 -

Sorry, I was out of the office yesterday and catching up. My understanding of behavior of NAPL in the subsurface is that NAPL thickness in a well is more of an indication of NAPL mobility than quantity. Steam is going to mobilize NAPL – that's the whole point of why we are doing it, to mobilize the NAPL to where it can be recovered. Mobilized NAPL will migrate to places where it can pool and will accumulate in to well casings as it is forced out of the formation. Doesn't necessarily mean that it is migrating past the well casing and back into the formation.

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**From:** Wayne Miller [<mailto:Miller.Wayne@azdeq.gov>]  
**Sent:** Tuesday, March 03, 2015 10:27 AM  
**To:** Davis, Eva  
**Cc:** d'Almeida, Carolyn K.; steve  
**Subject:** 2015-3-3 - wafb - thanks - LNAPL containment ST012 -

Thank you. ADEQ management issue is not strictly SEE-related (temperature). Management sees LNAPL in W37. Even if drawdown pulling LNAPL back to W37, management countered that plume had to be beyond W37 in order to be pulled back to W37. Management sees CERCLA purpose to be protective and restore. W37 only one point along plume, and not necessarily the downgradient limit point. If product is beyond SEE bounds and has dispersed away from active remediation site (assume while containment pumping turned off during SEE build), then ST012 remedy not protective and not restorative (of full release).

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**From:** Davis, Eva [<mailto:Davis.Eva@epa.gov>]  
**Sent:** Tuesday, March 03, 2015 9:45 AM  
**To:** d'Almeida, Carolyn K.; Wayne Miller; [steve@uxopro.com](mailto:steve@uxopro.com)  
**Subject:** 2015-3-3 - wafb - LNAPL containment ST012 - edavis epa -

Wayne ---

Since Amec is taking their time responding, and management may be breathing down your neck, let me give you some quick replies to some of your questions ---

LNAPL crossed Sossaman Road long before the full scale steam injection was initiated. In fact, I seem to recall that you guys noticed the LNAPL accumulation in W37 reported in the groundwater monitoring report for ST-12 even before I did. The final 2013 groundwater monitoring report shows that 5 gallons of LNAPL were recovered from W37 in 2013

(see table on page 3-11). That was the most LNAPL recovered from any ST-12 well in 2013. The lower table on that page shows no LNAPL recovered from W37 in 2012, the text on page 3-2 states that there was LNAPL in W37 in 2012 but insufficient quantity to recover it. Because this well has a submerged screen, and there is a semi-confining layer above it that (according to the site CSM) traps LNAPL at depth, a lot of the rules for LNAPL accumulation in wells doesn't apply here. I don't think we can tell anything about LNAPL being moved to this area by the fact that there is now a greater accumulation there – it very well might be that the groundwater extraction reduced the water level enough that more of the LNAPL was able to enter the well. It is very difficult to say. I believe W37 is a 4 inch diameter well, which means that that 70 feet of accumulation amounts to about 45 gallons, if my calculations are correct. Not much compared to how much is out there and how much has already been recovered. By continuing to extract more groundwater than is injected, LNAPL should not be pushed further away by the steam injection. The pressure cycling they will be doing later, where injection is scaled way back and extraction continues, will do more to pull some of that contamination back.

I've attached the steam injection issue paper that I wrote some years ago – it's outdated, but I believe there are a couple of points in there that are relevant to these concerns. One, is that temperature is a very good tracer. It was found at oil recovery operations using steam injection that temperature increases could be detected before any of the oil reached that monitoring or extraction point. So the fact that no temperature increase has been detected at W37 means the well is not being directly affected by the steam injection.

The second point is that the steam injection cannot really become 'uncontrolled'. There is a maximum size of the steam zone that can be created at a certain steam injection rate, due to the heat losses to the overburden and underburden. The steam zone cannot continue to grow uncontrolled in any direction.

Hope this helps until the response from AMEC is received -

Eva

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**From:** d'Almeida, Carolyn K.  
**Sent:** Thursday, February 26, 2015 4:21 PM  
**To:** Davis, Eva  
**Subject:** FW: 2015-2-24 - wafb - LNAPL containment concern - ST012

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**From:** Wayne Miller [<mailto:Miller.Wayne@azdeq.gov>]  
**Sent:** Tuesday, February 24, 2015 3:28 PM  
**To:** [catherine.jerrard@us.af.mil](mailto:catherine.jerrard@us.af.mil)  
**Cc:** d'Almeida, Carolyn K.; steve  
**Subject:** 2015-2-24 - wafb - LNAPL containment concern - ST012

Just wanted to make you aware of some ADEQ management concerns.

ADEQ Unit Management is disheartened to hear LNAPL reported east of Sossaman Road (well 37) via multiple monitoring periods. Management not convinced contaminant contained. Management questions whether sentinel wells exist to show LNAPL extent.

Management has directed staff to emphasize lack of confidence in ST012 containment.

Specific management questions:

- (1) How (what trigger event) occurred to allow LNAPL to migrate east of Sossaman Road?

- (2) When did the LNAPL cross Sossaman Road?
- (3) What time interval accounts for LNAPL migration
- (4) Is LNAPL migration ongoing?
- (5) Will LNAPL impact area further east?
- (6) Will LNAPL quantity increase as a result of SEE operations?

Management also ended with this quip:

- (7) Responsible party to provide proof/defensible data to show issue understanding and handling.

Wayne Miller,  
ADEQ, Federal Projects Unit  
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phone: 602.771.4121

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